Communicating about Chemical Body Burden, with Tracey Woodruff and Rachel Morello-Frosch

Ashley Ahearn

Biomonitoring studies reveal what we've been exposed to, but the significance of these exposures is not always clear—and when the participants in such studies are children or pregnant women, this lack of certainty can be especially unnerving. Reporting body burden findings back to study participants and to the general public therefore poses major ethical and logistical dilemmas, as Tracey Woodruff and Rachel Morello-Frosch discuss with host Ashley Ahearn.

AHEARN: It's *The Researcher's Perspective*. I'm Ashley Ahearn.

We're exposed to chemicals every day, from the liners of our canned goods to our living room carpets to the cosmetics in our bathroom cabinets. The field of environmental health science grew up, in part, as a way to assess our exposures to chemicals and try to understand the associated risks.

But for the general public, with so many chemicals in our environment and so many different exposure routes, it's easy to get a little paranoid—or what some might call "chemophobic."

Joining me to talk about chemical exposures and the public response are Drs. Tracey Woodruff and Rachel Morello-Frosch.

Dr. Woodruff is an associate professor and director of the Program on Reproductive Health and the Environment at UC San Francisco. Dr. Rachel Morello-Frosch is an associate professor in the School of Public Health and the Department of Environmental Science, Policy and Management at UC Berkeley.

Let's start with you, Dr. Woodruff. This past January you published an article in *EHP* characterizing chemicals in a sample of pregnant women in the U.S.[i] Tell us a little bit about your research and how it was received by the public.

WOODRUFF: Yes, this past January we published a paper that appeared in *Environmental Health Perspectives*, and in this paper we evaluated chemical body burdens in pregnant women across the United States using the NHANES, the National Health and Nutrition Examination Survey, which is a survey that's conducted by the Centers for Disease Control [and Prevention] through the National Center for Health Statistics. It's a representative sample of the U.S. population, and in the NHANES survey they collect biological samples from the participants, blood and urine, and then they take the blood and urine and they measure them for different environmental chemicals.

So we had 268 pregnant women across the United States. We analyzed data for 163 different environmental chemicals among these pregnant women, and what we found was that we had a baseline: essentially all the pregnant women in the United States are exposed to at least 43 different chemicals.[ii] So the chemicals that we found that were fairly ubiquitously measured among the women were banned chemicals such as polychlorinated biphenyls, or PCBs; organochlorine pesticides like DDT; and then we found a number of different contemporary chemicals including perfluorinated chemicals, or PFCs; polybrominated diphenyl ethers, PBDEs or flame retardants; phthalates; polycyclic aromatic hydrocarbons; benzophenone-3; and perchlorate. In addition, we found—not quite as ubiquitously, but in many of the different pregnant women—things like BPA, or bisphenol A; triclosan; and some organophosphate pesticides. So what this means is that pregnant women have many different chemicals measured in their body during a particularly important period of [fetal] development.

AHEARN: Now, Dr. Morello-Frosch, you're currently collaborating on a project with Dr. Woodruff to assess pregnant women and their exposures in the Bay Area. Tell me what you're going to be looking at with Dr. Woodruff in this new collaboration.

MORELLO-FROSCH: Well, this collaborative project that we call "Chemicals in Our Bodies" is looking at chemical exposures in pregnant women and their newborn infants. These are women who are delivering their babies in the county of San Francisco, and so we are recruiting them in their third trimester and testing their blood and urine for similar chemicals and chemical classes that Dr. Woodruff examined in her NHANES study to assess the exposure and to be able to compare exposures between mothers and infants. We'll also be asking the mothers a series of questions about product use, their home situation as well as their occupational exposures, to get a sense of whether or not we can understand a little bit more about what is driving the chemical exposures that we're seeing both in mothers and infants.

AHEARN: And you've done some research on communicating results to study participants. Could you tell me a little bit more about that?

MORELLO-FROSCH: Yes, a big part of doing biomonitoring or any kind of personal exposure assessment, even if you're monitoring people's household air and dust, is how do we communicate these results both to the broader public and to individual study participants. Biomonitoring has been with us for a very long time, and it used to be that we did these studies and we didn't report back these results to individual study participants in part because we didn't want to alarm them by telling them about chemical exposures in their bodies without being able to tell them anything in terms of what it meant for their health.

But the ethical standards for these kinds of studies are just starting to evolve, and study participants themselves are beginning to request and demand that these results be returned to them despite the scientific uncertainties associated with them. So a big part of the "Chemicals in Our Bodies" project, as well as other biomonitoring studies that I've been involved in, is developing ethical and scientifically valid protocols for reporting back these results to individual study participants and also answering some fundamental questions that most study participants have, and that is, you know, what did you find? Are the levels high? Is it safe? And what can we do about it?

And those are very reasonable and straightforward questions that we should be able to answer, and unfortunately the science is not quite there yet. So our ability to answer a lot of those questions, particularly the "Is it safe?" question and "What should I do about it?" is a bit more challenging.

But I think that despite some of those uncertainties we are still reporting these results back to study participants. And research really shows that participants are quite appreciative of getting these results, and they're not necessarily alarmed or fearful about finding out about chemical exposures in their bodies.

AHEARN: "Chemophobia" is a term that means "an irrational fear of chemicals." Given what we know about the extent of our exposures to chemicals like PBDE flame retardants and what we suspect about potential health outcomes, how rational are those fears, in your opinion, Dr. Morello-Frosch?

MORELLO-FROSCH: Well, I think that we have a major policy challenge before us in that we have chemicals that are in widespread commercial use, and the public is just learning that many of the products that they use, that they assume have been safe and fully tested, in fact have not been. So I think that people's concerns about chemical exposures is warranted, because a lot of these chemicals are in widespread use, and they have not been sufficiently tested for environmental and human health effects.

AHEARN: The American Council on Science and Health released a position paper titled "Scared to Death: How Chemophobia Threatens Public Health."[iii] Do you think chemophobia is threatening public health, Dr. Woodruff?

WOODRUFF: We know now from these biomonitoring studies that have been going on over the past, really accelerating over the past decade, that we are measuring many different types of chemicals in people, and a number of these chemicals—like mercury, lead, flame retardants, PCBs, PAHs, perchlorate—all of them have been associated with

adverse health outcomes, many of them have been associated with adverse health outcomes in human epidemiology studies at similar levels that are found ubiquitous across the U.S. population. I think that this raises the issue of are we doing enough to ensure that people are not exposed to environmental chemicals at levels that may adversely be impacting health, particularly reproductive and developmental health.

AHEARN: I want to get a little personal here for a minute. You both have families, you have homes. I'm wondering, what do you do to limit your own exposures, given all the research you amass every day in your work?

WOODRUFF: One of the things that's a little bit challenging about this research is it does make you start to think about all the things in your house and whether you are doing the things that can maximize the health of your family. So I know from my own personal experience we didn't do this like, one day I got up in the morning and tried to accomplish everything that we recommend in our own fact sheets, because that actually would be too difficult. That's just not realistic.

So it kind of evolved over time, but I stopped microwaving in plastic, then I switched out some of my containers. We don't have any pesticides in our home. We clean more often because there's a lot of—OK, that's kind of embarrassing to admit, but . . . There's a lot of chemicals that are in dust, so the more you keep dust levels down in your house, wash your hands more often . . . There's some very simple things you can do to actually reduce some of your exposures to different types of environmental chemicals. And then slowly over time we buy certain foods organic, slowly over time we've made lifestyle changes that have been borne out in many different studies to show that you can reduce your exposure to some of these different environmental chemicals.

People don't have to do all these things at once or even in sequence. Even things like I said, like washing your hands and keeping your house clean, can actually lower exposures to a number of these different chemicals. Also, eating a healthy diet can help

mitigate effects of exposures to environmental chemicals. So people can take things slowly, and they can still see results over a certain time period.

MORELLO-FROSCH: To add on to what Dr. Woodruff just said, I think public concern about chemical exposures and our efforts to talk to people about what they, as individuals and families, can do to reduce their exposures is creating a more informed and demanding consumer and that in certain cases, product manufacturers are trying to become more responsive. We're seeing some evidence of that, for example in efforts to phase out the use of BPA in certain baby products and the like. So I think that as we move forward in the slow-grinding process to address this policy gap in terms of chemicals policy, in the interim a more informed consumer will also entice product manufacturers to reduce certain levels of chemicals of concern in the products that they make. But these information-based strategies I think can also be tools for policy change over the long term.

AHEARN: Dr. Morello-Frosch, Dr. Woodruff, thanks so much for joining me today.

WOODRUFF: You're welcome.

MORELLO-FROSCH: Thank you.

AHEARN: Dr. Woodruff is an associate professor and director of the Program on Reproductive Health and the Environment at UC San Francisco. Dr. Rachel Morello-Frosch is an associate professor in the School of Public Health and the Department of Environmental Science, Policy and Management at UC Berkeley.

And that's *The Researcher's Perspective*. I'm Ashley Ahearn. Thanks for downloading!

References and Notes

[i] Woodruff TJ, et al. Environmental chemicals in pregnant women in the US: NHANES 2003–2004. Environ Health Perspect; doi:10.1289/ehp.1002727 [online 14 Jan 2011].

[ii] This extrapolation is based on the fact that the NHANES sample is considered representative of the general U.S. population.

[iii] Entine J. Scared to Death: How Chemophobia Threatens Public Health. New York, NY:American Council on Science and Health (2011). Available: http://tinyurl.com/3sjydbv [accessed 26 Apr 2011].

Ashley Ahearn, host of *The Researcher's Perspective*, has been a producer and reporter for National Public Radio. She is an Annenberg Fellow at the University of Southern California specializing in science journalism.